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# BOSTON SOCIETY OF CIVIL ENGINEERS

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Volume XVIII NOVEMBER, 1931 Number 9

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JOURNAL OF THE

BOSTON SOCIETY OF CIVIL ENGINEERS

Volume XVIII NOVEMBER, 1931 Number 9

# MOSQUITO CONTROL

By Edward Wright *

(Presented at a meeting of the Sanitary Section of the Boston Society of Civil Engineers, April 1, 1931)

The size of the audience tonight somewhat embarrasses me, because I had thought there would be only about half a dozen here. Furthermore, I do not know very much about mosquitoes, although I have had something to do with the administration of some of the work. My friend, Mr. Wales, Entomologist of the State Reclamation Board, did not appear until a few minutes ago, which now makes me easier in my mind.

Moreover, the Engineering Division of the State Department of Health has just moved from the old quarters on the first floor to the fifth floor in the east wing, and in the moving we disposed of many papers. One of those which we hesitated to throw away was a paper presented to this society by the late Prof. George C. Whipple concerning the mosquito campaign in 1920 or 1921, which is a very interesting paper. Attached to it were some clippings, and the headline of one of them reads, "Professor Whipple to scalp the mosquito." That was during the period when he was President of the Massachusetts Anti-Mosquito Association, which was a pretty lively association for a short time. I say advisedly "for a short time," for it still has a charter, maps, plans and all sorts of papers regarding methods for controlling mosquitoes, but is no longer very active. I went to a number of their meetings. I think Mr. H. P. Eddy, Jr., was a member of the Executive

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* Sanitary Engineer, Massachusetts Department of Public Health, and Chairman of State Reclamation Board, State House, Boston.

Committee when it was a lively association. Ten years before that there was a still earlier agitation regarding the elimination of mosquitoes from Massachusetts. This resulted in the passing of an act appropriating $2,000 to the State Board of Health for this purpose. Of course nothing could be done with $2,000 other than to collect information and distribute it to all the boards of health of the cities and towns in the State. I do not know the result.

Activity regarding mosquito control appears to come in waves every ten years. The next wave was in 1929, when the late Senator Kincaide of Quincy had been bitten by mosquitoes, and, being a member of the Legislature, in good standing, thought something should be done to eliminate mosquitoes from Massachusetts. So he came to the State Board of Health and said that it ought to control mosquitoes in Massachusetts. I believe he conferred with Mr. Goodnough, Chief Engineer, and the latter said, "No, the State Board of Health was not the board to handle mosquitoes." The Senator then went to the Department of Public Works and suggested they should turn to the control of mosquitoes. He met no enthusiasm there. Then he went to the Department of Agriculture, with little success. The Department of Public Safety and the Department of Correction might have been consulted. Finally somebody gave him the idea that the State Reclamation Board should function in this matter, and he jumped at that.

## STATE RECLAMATION BOARD

The State Reclamation Board was organized under chapter 252 of the General Laws, and this law has been amended at nearly every recent session of the Legislature. In 1929, Senator Kincaide and his friends added more sections to that law, whereby any city or town, or group of cities and towns, could petition the Reclamation Board to organize a mosquito control project. The Board appoints commissioners, who proceed to carry on mosquito control measures under the supervision of the Board and under local contributions or appropriations. The Reclamation Board consists of a representative of the Department of Agriculture, a representative of the Department of Public Health, and a third man appointed by the Commissioner of Agriculture and the Commissioner of Public Health. Mr. L. B. Boston is the representative from the Department of Agriculture, and General Hale, Associate Commissioner of Public Works, is the third appointee. The three of us have been operating for a year and a half or so, and a great deal of work has been thrust upon us. We are supplied with an engineer in the person of Col. P. M. Churchill, a member of this society, Mr. R. W. Wales as Entomologist, a secretary, Mr. G. W. Stratton, and two or three stenographers, etc. The Board's appropriation before the mosquito amendment was passed amounted to about $2,500. Since the mosquito business has been added to our duties our budget has amounted to about $17,500. We are an advisory board only, although we have the say-so on the expenditure of the funds that are appropriated locally. All of the drainage work and all of the mosquito control work up to last month has been carried on under local appropriation or contributions.

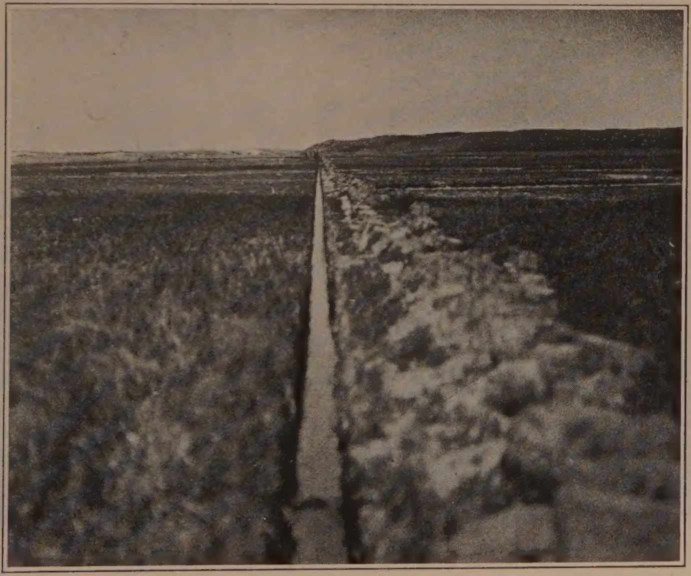

FIG. 1. COMPLETED DITCH ON CAPE COD.

## MASSACHUSETTS MOSQUITO CONTROL ASSOCIATION

The Cape Cod Chamber of Commerce became very much interested in this matter in 1929 and felt it was a very vital thing for the Cape to do something about mosquitoes. During that year there was organized the Massachusetts Mosquito Control Association which was quite active for a time and now maintains an office and secretary. The first president of that association was Col. Frederick L. Payne of Greenfield, who accomplished a great deal up to the time President Hoover appointed him Assistant Secretary of War. The association has materially assisted in legislation, and as a result of its activities an act was passed appropriating $20,000 to construct a dike in Provincetown to keep water from the Province Lands.

## Cape Towns Appropriate Money

Other legislation was passed requiring the towns on the Cape to appropriate money for mosquito control at the rate of 25 cents on $1,000 of valuation. Work was started less than a year ago on draining the salt marshes in Barnstable County. There are about 20,000 acres of salt marsh and 5,000 acres of fresh water marsh in Barnstable County. The work so far has been entirely on the salt marshes, where the mosquitoes buzz most lustily and bite most voraciously, and are in general most pestiferous.

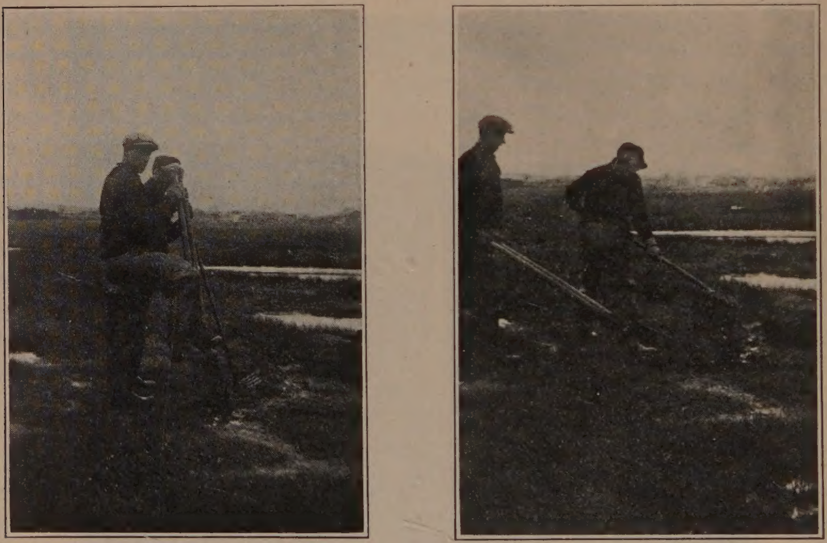

Fig. 2. — Methods of Ditching — Handwork

Coincidentally with that work a project was instituted in Nantucket. Their appropriations and subscriptions amounted to some $15,000. We feel very proud of the work at Nantucket. If any of you were there last summer, and had been there before, you would have noticed a difference. Especially in the westerly end of the island, the Maddeket section, mosquitoes had been so thick that people having gunning stands could not use them during the mosquito breeding season. After the work had been completed, people could live in their camps without screens, and the valuation of the property in the Maddeket section and in other sections of the island has increased from 100 to 150 per cent.

On the Cape, 25 cents on $1,000, amounting to about $25,000, was obviously inadequate to control the salt marsh breeding areas, so it became necessary to raise additional funds. Consequently the Cape Cod Chamber of Commerce organized a drive in August, 1930, which netted over $200,000. That money was forwarded to the State treasury and can be spent on the work only under our advice and approval.

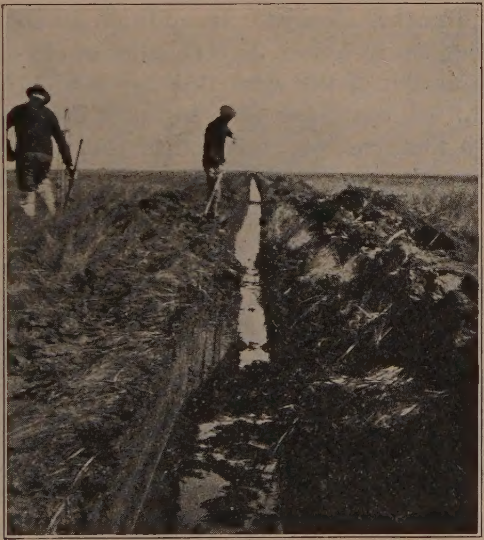

FIG. 3. — DITCH CUT BY PLOW; ALSO SHOWS WIDENED DITCH MADE BY SECOND CUT OF SAME PLOW

## WORK UNDERTAKEN

The systematic and scientific methods of controlling mosquitoes were not generally known locally on the Cape. Colonel Churchill and Mr. Wales had the necessary training and experience, and, as soon as the Commissioners had been appointed, the work was discussed with them. They proceeded to employ a superintendent, hired foremen and laborers, and proceeded to secure equipment. To date 394 miles of mosquito ditches for draining wet breeding areas have been dug. These ditches are about 24 inches deep and 10 inches wide. There is no particular engineering feature in connection with the ditches in the salt marsh. It is necessary to go down through the turf to sand if it is not more than 20 to 24 inches deep, and it is necessary to connect all the pools with the ditches so that the pools will dry out. Now one can walk where these pools were and not get one's feet wet, and no rubbers are needed except after extreme high tides. Before this drainage was carried on one could not reach these marshes. The Cape Cod Mosquito Project Commissioners forward to the Board weekly reports which give the weekly expenditure in each town, the amount paid for labor, materials, etc. Only $250.29 has been spent thus far for oil, not including oil and gas for cars. The reports state the linear feet of new trenches, and of trenches cleaned. In addition to the amount of new ditching (394 miles) up to March 27, 114 miles of old ditches have been cleaned. The total cost of the work thus far is $70,172.20, which prorated amounts to 3.4 cents per foot for new ditches, and including ditches cleaned, a total cost of 2.6 cents per foot. That includes overhead, such as two automobiles, a truck and a boat, and salary of the superintendent.

The first work done was under contract with John F. Ross of New York, for 1,000,000 feet at 2½ cents per foot.

## Legislature Appropriates $270,000

One interesting part of this story is that 88 per cent of the total cost has been spent for labor. That information came to the Governor about March 1, and he felt that it was a good method of putting the unemployed to work. Consequently he sent a message to the Legislature urging an appropriation of $270,000 for use in Bristol and Plymouth counties, which was our estimate of the cost of doing the work in those two counties. The Legislature felt that the distribution of this fund should be left to the State Reclamation Board, and this was incorporated in chapter 112 of this year's acts, passed March 16. The primary object was to use the unemployed on this work.

There has been a great deal of pulling and hauling to obtain some of this fund, but from its experience on the Cape last summer the Board immediately allotted the fund to the coast line from the Rhode Island line through Bristol County along the South Shore and the North Shore. The first duty was to appoint commissioners to carry on the work. A really tremendous number of unemployed have applied for jobs. The first spadeful of earth under this new system was dug on March 31, in Somerset. The Board has allocated this money to areas reasonably close to municipalities containing large numbers of unemployed. No money has been allotted to the Metropolitan District, because certain appropriations for employing labor in this district have already been made.

## DIKE AT RACE RUN, PROVINCETOWN

The most interesting work in Barnstable County from an engineering standpoint was the construction of a dike across Race Run in the Province Lands at Provincetown. This dike is about 3,300 feet in length and is constructed to grade 17 of a sand fill with a top width of 8 feet and side slopes on the outer side of 2 on 1 and the inside of 1½ on 1. The outer side slope is covered with 24 inches of sod, the top with 6 inches of sod, and the inside with 12 inches of sod. The dike is provided with an outlet structure constructed of concrete with a 24-inch opening and a tide gate. The dike was designed and constructed by the Department of Public Works in consultation with the Reclamation Board at a cost of $20,000. Thus far it has stood the heavy storms with no difficulty. It is too early to determine whether or not it will eliminate the mosquito breeding areas in the Race Run district which has formerly been known to be the most serious mosquito-breeding area on Cape Cod.

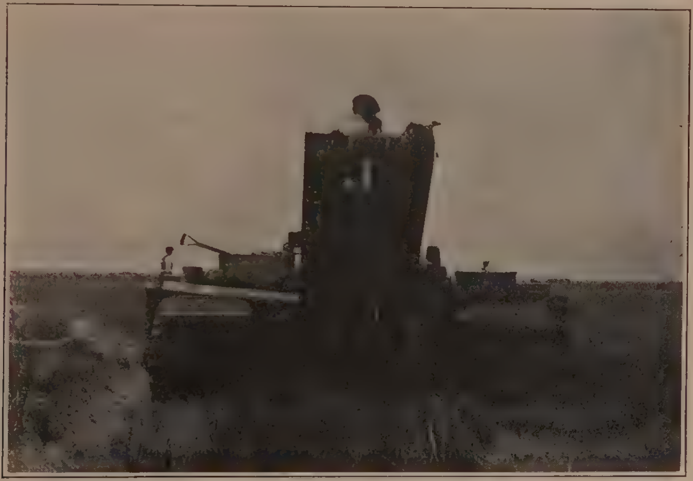

FIG. 4. — THE REILEY PLOW
Used in New Jersey (Atlantic County)

## Other Problems

The next most difficult problem from an engineering standpoint is the Waquoit Bay area in Falmouth and Mashpee, where a sand obstruction prevents tidal action over an area of seven or eight square miles. This matter is now being investigated, money is available for the removal of the obstruction, and presumably action will be taken this year.

Another problem is in the Powers Neck district in Yarmouth, where the outlet to an extensive swamp area has been sealed by heavy storms. Surveys have been carried on with a view to constructing a new outlet, but only this morning the papers state that the recent storm has opened the former outlet.

The Board has made certain studies relative to permanent outlets. In New Jersey a new system is being tried which provides for an inverted siphon at the shore line having an outlet below low water so that the pipe will be well buried at the water line where it will not be readily affected by heavy storms. Of course this is very costly, and I do not see how this method can be used in mosquito control work. We are very fortunate in having on the Board General Hale, who is a member of a Federal committee on shore protection.

## Maintenance

Maintenance is, of course, the bugaboo of this whole business. We can spend $200,000 on the Cape and $270,000 along the rest of the shore and the ditches will operate nicely, perhaps, during one breeding season, but the winter will fill them full of débris, and it is absolutely essential that steps be taken to maintain this work. The ditches cost two to three cents per foot. Maintenance costs about 10 per cent of the original construction cost, and such work should be carried on annually, or at least at very frequent intervals. In order to take care of this maintenance work on the Cape a bill* is now on its way through the Legislature that requires the state to make an annual appropriation of 25 cents on each $1,000 of valuation of the Barnstable county towns and assess the amounts on these towns as a part of their State tax.

Maintenance is taken care of in the recent emergency bill in the following manner:

> Section 4. On or before December fifteenth in each year, the sums of money necessary to properly maintain during the ensuing year the mosquito control works originally constructed in any city or town hereunder shall be estimated by said board

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* This became chapter 315, Acts of 1931.

and certified by it to such city or town. The amounts so certified shall be raised and appropriated by such city or town during said ensuing year and shall be paid into the state treasury and disbursed therefrom on warrants drawn by said board.

### WORK IN MARSHES IN NEW JERSEY

Most all of the work on the huge marshes in New Jersey is carried on by machinery, because of their great extent. The largest marsh in Massachusetts is in Rowley, and that is small compared with some of the New Jersey marshes.

Some of the work there has been done by a type of machine that was designed by Superintendent Reiley of the Atlantic County work. It cost about $5,000 or $6,000. It cuts a very clean ditch and can be operated nearly anywhere. It is not practicable to use a machine like that in the smaller marshes such as we have along our coast line, where there are very few ditches more than about a quarter of a mile long.

### TYPE OF SPADE FOR HAND WORK

All of the work in Massachusetts is being done by hand labor. Nearly everybody who has been in the mosquito business has invented a two-man spade. One type of spade is the Eaton spade. Perhaps Mr. Wales can name thirty or forty others. We finally found one in the Cape work on which the patent had run out. Mr. Myhre, superintendent of the Cape work, has made his own spade, but has not patented it. The Eaton spade costs about $32, so we were pleased to get some one on the Cape who could make one for $18, and we thought we would have him supply spades for our work all along the coast line. Now we find a man in Bristol County who can build a spade for $8, and it is apparently as good as any spade used before.

## Discussion

MR. ROBERT W. WALES.* It has occurred to me that there are perhaps two or three things in connection with mosquito control which are of particular interest. One of these is the emphasis which was laid upon the salt marsh mosquito and practically nothing said about other mosquito control work.

One reason for this is that, as soon as the act was passed by the Legislature, giving the State Reclamation Board power to undertake this mosquito control work, the Cape Cod Chamber of Commerce immediately applied for a survey of Barnstable County. The first survey was made there, and it was found that there was so much to do in that district that there was not much chance to do anything anywhere else. However, from all I have been able to find out, the salt marsh areas of the State are undoubtedly the worst infested in so far as mosquitoes are concerned.

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* Entomologist, State Reclamation Board, Boston, Mass.

There are various types of mosquitoes, — one, the rain barrel, or "house," mosquito; the malaria carriers, or anopheles; and another group, by far the most important, which we don't hear very much about. It is a little different in its habits from the others. The eggs are laid generally upon dry or moist ground in places sooner or later flooded with water. This permits a tremendous accumulation of eggs, and when the area is flooded there result billions of mosquitoes. The salt marsh provides just that condition. The salt marsh mosquitoes, of which there are two species here, lay their eggs on the marshes. When the monthly high tides occur, the marshes are flooded and great quantities of eggs hatch at the same time over the whole marsh area.

Either because there is not room enough in the air, or because there is not food enough, these mosquitoes tend to work inland, and from our observations we have found these salt marsh mosquitoes ten to fifteen miles from the marshes, and even inland where one would naturally expect to find the local mosquito. In New Jersey, where most of the early work on mosquito control was done, particularly on the pestiferous as opposed to the disease-carrying mosquito, flights of the salt marsh mosquitoes have been traced forty miles from the marshes.

With that information and the results of our own investigations it was felt that here, surely, was an extremely important problem as far as mosquito control was concerned. Of course, it is possible, also, to get tremendous numbers of mosquitoes in fresh water areas, as in Alaska, Labrador, etc. These have much the same habits, laying their eggs in summer in dry spots and along the flood plains of rivers, which in the early spring are flooded with snow water or by the early spring rains. This is not the same species as the salt marsh mosquito, but the same genus, and has the same general habits, so the work here has been largely concerned with the salt marsh mosquitoes.

The method of control used was developed in New Jersey. It was found not practicable to control these mosquitoes by the use of oil. All the breeding pools must be reached certainly within a week after the high tides. After a week, the mosquitoes leave the water. A great many places on the salt marshes are extremely difficult to reach. Oil is not practical for the control of this species of mosquito, consequently the method of ditching was developed. The system works in this way. Ditches are connected with the creeks, thus providing outlets to tide water. They are deep enough for the ordinary high tides to reach the bottoms of the ditches, and they also prevent water from standing on the marshes, thus keeping the top of the marsh dry. Generally the ditches are about 100 feet apart. In some places they are a little closer. In New Jersey they are 150 feet apart. The spacing depends on the nature of the marsh. They are dug 2 feet deep, unless the marsh is underlaid by sand and the sand comes close to the surface, in which case digging is only to the sand, because sand caves in. By keeping water in the ditches, killifish and other salt water minnows get in and keep the ditches clear of larvæ.

Prof. Gordon M. Fair:* You said the salt marsh mosquito flies inland and may infest fresh water regions. If a salt marsh mosquito lays its eggs in fresh water, will they hatch?

Mr. Wales: It has to fly back to deposit its eggs in its natural habitat, or else it doesn't reproduce.

As far as the salt marsh mosquito is concerned, we get during the summer two species. *Aedes cantator* is quite numerous in May or June. In June, also, we get the striped salt marsh mosquito, *solicitans*. We get the latter species in greater numbers than the other through July and August, and sometimes as late as September. The first species we find only near salt water, but we do find them in water which is only very slightly salt. In Cambridge we found a number along the salt marshes of Charles River. Here the water is only very slightly salt. There is a salinity of only about one-fourteenth in Boston Harbor. We found some around the clay pits at Cambridge, where there is no salt water at all. We never get them inland. There is no evidence of either of these species breeding inland in fresh water.

Mr. Johnson, who is to speak later this evening, tells of getting salt marsh mosquitoes in Louisiana or Oklahoma in the oil sections. The salt water comes to the surface owing to the oil wells. Some of the mosquitoes had been imported and began to breed there.

Mr. Frank L. Flood:† What is the cost of the machine for digging the ditch, shown in the film; both for digging the original ditch and for maintaining it?

Mr. Wright: I think that is mentioned in our report, Senate, No. 4. I think allowing two or three years' ordinary life to the machine, the cost for new ditch is about 1¾ cents per foot, and for cleaning, 1 to 1½ cents per foot. Six hundred feet of ditch in New Jersey, dug by machinery, cost 1.12 cents per foot, including overhead and depreciation of machinery.

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* Professor, Sanitary Engineering, Harvard University.

† Assistant Engineer, Metcalf & Eddy, Statler Building, Boston.

MR. ALMON L. FALES:* I would like to ask Mr. Wales or Mr. Wright to set me right if I am wrong in my understanding that you are not attacking the malaria mosquito, — the *anopheles*, — but are attacking the marsh mosquito which I take it is the *Mephistopheles*, including, perhaps, the *solicitans* variety and the *cantator* variety, which is particularly musical at times; and perhaps not carrying out public health measures, but, rather, measures for the public comfort.

MR. WALES: Yes, we are interested particularly in the public comfort. Apparently there is no great malaria problem in Massachusetts. We have plenty of the *anopheles* mosquitoes here. It is easy enough to find them, but cases of malaria itself are very scarce. In addition to *solicitans* and *cantator* there are two other species, — *perturbans* and *vexans*.

MR. WRIGHT: Malaria is a reportable disease in Massachusetts, and there were only 40 cases reported this year and we think that 38 of those were imported. We have looked that up quite carefully.

PROFESSOR FAIR: It must not be forgotten that at one time Massachusetts was quite a malaria State, and at the time the water supply developments were being made a good deal of malaria was brought in by Italian laborers, especially when work was being done on the Cochituate and Wachusett reservoirs. In preparing for the new work they have taken that into consideration. Why it should have disappeared it is hard to say. We have *anopheles* in Massachusetts and it seems to be an economic problem to some extent. As the standard of living improves there is very little malaria in Massachusetts. If you go to the Metropolitan Museum of Natural History in New York, however, you will find a very fine model showing the engineer's relation to the suppression of malaria in the Fresh Pond area in Cambridge, where the building of a railroad had created a marshy area with resultant cases of malaria in neighboring sections of Cambridge. It may again be a problem with the construction of highways or any engineering project which does not take into consideration drainage of the lands.

MR. H. A. JOHNSON:† Mosquitoes are world-wide. They extend from the torrid zone to clear inside the Arctic circle. In all those areas they are extremely bothersome. There are two types, — the disease-carrying mosquito, found mainly in the tropics and the sub-tropics, and the pestiferous type. Those two types present two entirely different problems. The problem presented by the disease-carrying mosquito is a health problem, and is connected with backward development in the sections where the mosquitoes exist with malaria and yellow fever and other mosquito-carried diseases.

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* Of Metcalf & Eddy, Statler Building, Boston.

† Past Assistant Sanitary Engineer, United States Public Health Service.

The problem of the pestiferous mosquito is mainly one of economic development, of comfort and of convenience. There is the house mosquito, which breeds in containers, ditches and ponds, and the salt marsh mosquito. Usually the house mosquito lays its eggs in such sequence that there is a continuous hatching of adult mosquitoes, and not a tremendous influx, as with the salt marsh type. The house mosquito is limited in its flight. It very seldom travels over a mile, so that the problem of its suppression is entirely a local one. It is not a problem for the State to solve, it is for the community to solve.

The salt marsh mosquito, on the other hand, presents another problem. It flies or is carried considerable distances. It lays its eggs on the marsh above the water level, and when high tides come the eggs hatch all at one time and tremendous numbers of mosquitoes leave the marsh, and this is a problem which it is up to the State to solve. It cannot be handled in the same way as the house mosquito. Salt marsh mosquitoes do not carry disease, but they do create a difficulty out of all proportion to any difficulty presented by any other mosquito, — the difficulty of a long flight. The life history of mosquitoes is practically the same for all species. They lay their eggs, and these hatch at one time or another into wiggle tails. After a while these turn into pupa, which last only a day or two. The skin rips off and the adult comes out. There are therefore four stages, three of which are in water, and it is in that water form that they are limited and the best opportunity is then afforded to control or get rid of them. Salt marsh mosquitoes do limit the development of real estate and the most potentially valuable lands we have today. In the control of this mosquito we can do no better than follow the New Jersey experience. I will not go into details, because you only have to get the yearly reports of the New Jersey Extermination Association to see it clearer and in more detail than I can hope to give it to you.

There are one or two fundamental factors in the control of the salt marsh mosquito. The surface pools in the marshes breed the mosquitoes, not especially the drainage ditches. In New Jersey certain methods have been developed by which salt marsh mosquitoes have been most efficiently handled. It is by a system of ditches approximately 10 inches wide and 24 or 30 inches deep, which are dug to drain the pools and gradually lower the water level in the marshes. This has been found the most economical and feasible method of control. There are two methods, — one, the checker board system, in which the ditches are connected with the pools and the water is led off into tide water; the other system is the so-called "parallel" system. All the ditches are dug parallel to each other, usually depending on the porosity of the soil, to drain the pools, or occasionally short spurs are run into the pools to connect them with the ditches. The parallel system is now considered the most practical.

The question of maintenance, mentioned before, is a very important problem in salt marsh work. It is not a question of controlling a square mile one year, and the next year the control abandoned. The question of salt marsh work is one of large-scale work. It is a proposition which must be planned in advance and properly financed, and should be adequately maintained and provision made for taking care of the expensive drainage systems once they have been put in. If a campaign of salt marsh mosquito control is adequately planned and financed, and provision is made for maintenance of that work, there is no better investment for State and county funds than salt marsh mosquito control work. The increased value of lands in New Jersey testify to whether or not salt marsh mosquito work pays. The economical side of salt marsh work appeals to the people of New Jersey. The New Jersey people are spending close to $1,000,000 a year for mosquito control. They find it is the best investment of State and county money. It increases real estate values and trade and development comes as a result of it.

Some one mentioned the salt marsh mosquito coming inland following the oil business in Oklahoma. That is a fact. Also in southern Arkansas and northern Louisiana the salt marsh mosquitoes appeared in the salt water flows from the oil wells. In some places they are so bad that farmers have to wear nets about their heads when they are ploughing. It is a serious problem. They are 600 to 700 miles away from their natural habitat.

But why control mosquitoes at all? There are a number of good reasons. One is that we want to promote the possibility of the development of real estate. Real estate near these salt marsh areas is probably not producing 10 per cent of what it would if it were not for the mosquito problem. Again, mosquito control has been found to be a most attractive investment for State and county funds. Third, it attracts tourist trade, which is no small item to any community. Fourth, people are spending millions at the present time for luxuries; why can't they wake up and pay a few thousand dollars for convenience and comfort.

Fifth, wherever salt marsh mosquito work has been done it has been found to yield an excellent return on the money invested.

Why should the engineer be fundamentally interested in mosquito control? The main one is that the work of the engineer is most closely correlated with the building in or out of the mosquito the world over, whether *anopheles* or the salt marsh variety. Second, engineering work has been responsible for all of the successful mosquito control work that has been done; and also responsible for some failures. Third, the engineer is looked up to as an authority on mosquito control, and often finds himself involved in court cases where mosquitoes are concerned. In the Southern States, where there are large impounded areas, practically every impounded pond has its court case sooner or later, because of mosquitoes. The legal aspect of mosquito control confronts the engineer. The public has demanded mosquito control. It has become educated and realizes that it is no longer necessary to endure the torture from mosquitoes that it has in the past. People want to live more in the open and they don't want to be bothered with mosquitoes. They know mosquito control is possible and are looking to somebody to do it.

In conclusion I may say that mosquitoes bite from the reproductive instinct. Mosquitoes have to have a meal of blood before they can lay a fertile egg. It is the female of the species that gives us the most trouble. They have to have a blood meal before they can lay a fertile egg. It is this instinct that makes them such pests.

Mr. John F. Pierce:* My contact with the mosquito is limited to that of the innocent bystander. I have had the experience of sleeping under a net, but not of working under a net.

With respect to the mosquito situation in Cuba, it is necessary to divide Cuba into Havana and Cuba. You are all familiar with the events which led to the independence of Cuba, and you are probably familiar with the terms of the Treaty of Paris which made the country an independent nation. There is a clause that Cuba has to maintain certain sanitary conditions established by General Wood. The Cuban people have stuck to it very closely, either from fear of another intervention or from appreciation of proper sanitary control. Sanitary control is under the Department of Sanitation, undoubtedly the most efficient department of the Cuban government. The Department is run on a military basis. The chief passes his orders down through the other officers to the four or five men having direct charge of the section in question. Havana is a very clean city. It has the reputation of being one of the cleanest cities in the world. It is the cleanest I have ever seen. The people of Cuba are very much concerned about health. They have hospitals all over the island, and their sanitary laws are quite rigidly enforced. They are now enforcing the pasteurization of milk. It is quite a new sensation to be able to go to bed at night with the French windows open and not a screen in the house. For the thirteen months I was there — during the winter season and the warm season — I did not see a fly or a mosquito in Havana. But when you get outside of Havana any numbers of mosquitoes are lying in wait for you. They don't come into Havana. The Street Cleaning Department is very efficient. The city is divided into districts and the districts into sections. Every district has an officer to look after the sections. He is responsible to the Secretary. The district is divided into divisions and the divisions into blocks. Each block is in charge of one man. He is in uniform and has a push cart and broom. They work continuously for twenty-four hours a day in two shifts. You very seldom see a newspaper on the street, or any dirt. Large trucks haul away the refuse. There are inspectors around all the time. The system of garbage collection was very carefully worked out by Colonel Wood. The city is divided into districts, which are in turn divided into sections. Garbage is collected by men and trucks. The trucks are large and specially designed for that particular work. Collections are at the same hour every day. A man, in uniform, takes your bucket and empties it into the truck and brings it back to the doorstep. Then along comes the inspector, and if it isn't empty somebody gets reprimanded.

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* Consulting Engineer.

If a man has a back yard and is fortunate enough to have grass growing in it he has to keep it cut very close; if not, the inspector will get after him. In most Cuban houses there is a patio in the center, and in the patio there is usually a fountain. If you haven't gold fish in the fountain pool when the inspector comes around you have to buy some from him. He carries them about with him in a little bucket.

Another department puts oil down all the sewer drops. This goes out into the bay and along the water front, and for days you can see a film of oil all over the water. The house sewage goes into the sewers and through large pipes under the harbor near Moro Castle, where it is pumped out to sea and discharged. The garbage is taken to sea and deposited way out. Occasionally we get a breeze off the ocean and some of the garbage comes back, but that occurs very seldom. The meat shops are all inspected, so that they cannot keep meat unduly long; and all the shops are very clean.

But get outside of Havana — each town has its own chief of sanitation acting under the National Board of Sanitation. These men as a rule are not posted on sanitary matters. They collect the garbage and keep the streets clean, but they do not get rid of mosquitoes. Outside of Havana it is necessary to sleep under nets all the time. In the hotels they have a very good contraption over the beds, but sometimes there are holes in the nets — I don't know whether the laundry made them, or the mosquitoes.

The main health troubles on the island are catarrh and tuberculosis. There are many tuberculosis cases, but not many cases of malaria. I did hear of one case, but the man wasn't so ill that he had to stay in bed.

The water supply is controlled by the Board of Sanitation, which keeps closely to the standards of the United States Public Health Service. Most of the supplies are chlorinated.

The sanitary systems of all the towns except Havana leave much to be desired. Santiago de Cuba hasn't much of a water supply. A year ago they were getting water one day out of seven. Now they are building an aqueduct to improve that condition. But it is surprising how comfortably a person can live even outside of Havana and never contract a contagious disease. Cuba has one of the lowest death rates of any country in the world.

Mr. Coburn: I heard some one say he noticed mosquitoes in damp places through the winter.

Mr. Wales: The house mosquito hibernates. Late in the fall, possibly as late as November, we get mosquitoes in the house, frequently in the cellar. Witness my own experience this winter. I had an aquarium stored in the cellar, and put water in the bottom to keep the cement from drying. Three or four weeks later, in December, I happened to notice it was full of mosquito larvæ. I don't know whether those mosquitoes on maturing would have reproduced and could have bred more, or not. I am inclined to doubt it.

Mr. Francis H. Kingsbury (Chairman):* It has just come to my mind that one of the largest drainage problems in Massachusetts — the improvement of the Neponset River — was brought about by the understanding that the meadows along the Neponset were responsible for malaria. I believe the first investigation in that connection was in 1896 and the work was carried out between 1911 and 1915.

Mr. Edgar S. Dorr:† I would like to ask a question regarding the salt marsh mosquito. There seem to be two conflicting methods. Where the dike was built the intent was to keep the salt water off entirely, and any drains involved were provided with tide gates to keep the water out. In the other method ditch digging was resorted to for the purpose of letting tide waters rise through the ditches and keep out mosquitoes. In that case the eggs the mosquitoes lay would probably be floated off by the high tides. I would like to know whether my understanding is right, and if so, which is the best policy to keep the water off altogether, or to flush the meadows?

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* Senior Assistant Engineer, Massachusetts Department of Public Works.

† Consulting Engineer.

Mr. Wales: I am very glad that question was asked. The conditions at Provincetown where the dike was built are different from those of the ordinary salt marsh. Provincetown is at the very tip of the Cape. This inlet at one time extended very much farther, but now the water works in from 1½ to 2¾ miles. Outside is a sand beach with high sand dunes. This low area is largely sand, although there is also some salt marsh sod, only two or three inches deep. There is practically no fresh water, although there may be a few springs. It was obviously not practical to ditch that area on account of the sand. Ditches could not be maintained because the tide would wash them out, or blown sand would fill them. That method had to be counted out. The other method was to keep the water out. In an ordinary salt marsh, if the water is kept out the marsh shrinks and there is possibility of rain water accumulating. But the land at Provincetown is practically all sand, and the water leaches away very quickly, so in that particular case, by keeping the salt water out, no water would be available for mosquito breeding.

While the two methods seem contradictory, they represent different methods of mosquito control.

Mr. Dorr: That inspires me to ask another question. Wouldn't it be better engineering to provide ditches with tide gates and keep the salt water out entirely?

Mr. Wales: We do not have salt marsh mosquitoes in marshes which have been properly ditched and which are properly maintained. As long as we get circulation of water we have no trouble. We frequently find small areas of marsh cut off by means of sand beaches or dikes, and sometimes areas of that sort have been provided with a tide gate. Where a tide gate has been put in, and there is a considerable area of fresh water above it, you will get fresh water breeding. Sometimes cat-o'-nine-tails will grow up, and there is a species of mosquito which especially favors these. We find that we get large areas of fresh water that way which may produce mosquitoes, but if we keep the area in salt marsh, and keep it well flushed, we do not have that problem.

MR. FALES: Did you say fish came in? Is there any significance in that?

MR. WALES: Anywhere on the marshes if you see even a ripple made by minnows you won't find larvæ in that pool. Fish will keep them cleaned out. We depend on that to eliminate breeding in the ditches.

MR. H. P. EDDY, JR: * Weren't most of the Barnstable marshes full of fish?

MR. WALES: The deep salt holes generally are. Once in a while, where the pools are only two or three feet in diameter, there may be mosquito larvæ present. We are connecting these pools with the ditches and draining them, to lower the water table of the marsh. In very few cases have we found larvæ in the large deep pools.

MR. EDDY: What is going to be the effect on the general level of the marsh after it is ditched and drained, after five or ten years?

MR. WALES: I wouldn't say it would harm it, because tide water enters there every day, except for two or three days on the extreme low run of the tides.

MR. EDDY: Are these pools in there eventually going to disappear? Are you going to lower the ground water level so much between high course tides that those pools will not exist?

MR. WALES: I would say not, although this is an opinion only. Most of those pools are quite deep. Of course, they will still get tide water in and out by means of the ditches.

MR. EDDY: What is the reason for piling the sods up in haystacks?

MR. WALES: The reason on the Cape is that we don't know what else to do with them. Those sods on the landscape are sods washed from the sides of the ditches during the high course tides which occurred this winter. Most of the work on the Cape has been done since October. There has been no opportunity for the sods to grow into the marsh. There have been several extremely high tides this winter, due to a combination of high course tides and northeast storms. The marshes were flooded again and again, and the sods floated over a considerable area.

MR. EDDY: Is there any objection to leaving them on the sides of the ditch?

MR. WALES: We do, but if that is done they should be pinned down, and that again is a rather expensive proposition.

We considered using the ditching machine here, but on the Cape, for instance, there are only two large marshes — at Barnstable and at

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* Of Metcalf & Eddy, Statler Building, Boston.

Yarmouth. The others are all small, and the problem of using a machine of that sort and transporting it from marsh to marsh didn't appeal to us. On the North Shore I believe it would pay, because there is almost continuous marsh land from Gloucester to the New Hampshire line. On the other hand, there is unemployment which would not be helped if we used the machine.

MR. KINGSBURY: At Marshfield there is a tide gate which has been there for several years, for other purposes, has this decreased the number of mosquitoes?

MR. WALES: I haven't been in that area at all during the breeding season. I was down there just after the last bad storm, and found no water had gotten in over the dike, and most of the area was quite dry. Mr. Churchill says there is extremely little breeding in there, but of course there are tremendous quantities of adult mosquitoes on account of the large salt marsh breeding areas in Marshfield and Duxbury outside of the dike.

MR. FALES: If it is true that the marsh mosquitoes lay their eggs on the relatively high areas and then depend on the tides to come in and flood them, and you then get large numbers breeding on those marshes and being carried or flying away, wouldn't the same thing occur with the ditches as without the ditches? What is the changed condition?

MR. WALES: The higher areas, of course, are the areas around the edge of the marsh where we get most of our breeding, and these are drained by the ditches. These are placed in such a way that water cannot stand on the marsh more than two or three days. We have a limit in there of probably six days from the time the eggs hatch until they mature. If the water dries out in that time we are safe.

MR. DORR: We have heard about combating the mosquitoes on the salt marshes. The mosquitoes are not all there. There are considerable numbers of mosquitoes in cities, and in all probability they breed there, when you consider that catch basins are enormous breeding places, and that there are about 20,000 catch basins in Boston. These are 5 feet in diameter with water standing in them all the time, and would probably aggregate about ten acres. If we had a ten-acre pool anywhere I think we should know where the mosquitoes were coming from.

MR. WALES: There is no question but that catch basins under certain conditions in summer are a source of a large number of mosquitoes. The mosquito which breeds in these is the house mosquito, which will breed in any receptacle around the house. As I see it, the principal problem in mosquito control is one of mosquito density. We get complaints where mosquitoes are very thick. In some inland towns we get mosquitoes always, but do not mind them particularly because they are not very numerous, but when you get such tremendous numbers as occur on the salt marshes at Provincetown, it is a serious problem. In the cities, if you want to get rid of all mosquitoes, then the catch basins must be considered. An effective method of preventing catch-basin breeding is used by the Des Plaines Valley Mosquito Control Commission. The sides and walls of the catch basins are sprayed once a month with hardwood tar oil. This prevents the mosquitoes from getting in to deposit their eggs. Another method is regular oiling of the basins. In any city where you want to get rid of mosquitoes entirely it is necessary to attend to the catch basins, and also watch for all possible breeding places.

PROFESSOR FAIR: In Cambridge last summer we oiled 4,000 catch basins regularly.

MR. WALES: I understand that in the catch basins in Cambridge they did not find the larvæ in all, but did find them in some, which seems to prove that mosquitoes will breed in them when conditions are favorable.

PROFESSOR FAIR: You don't find them in the catch basins on streets where there is a good deal of automobile traffic. Apparently enough of the oil had been getting in.

A vote of thanks was extended to the Speakers who are not members of the Society.

# OF GENERAL INTEREST

## COMMITTEE ON RUN-OFF

The Board of Government of the Boston Society of Civil Engineers voted on April 9, 1931, to authorize the President to appoint a Committee on Run-off to review and assemble to date all available data and records during the past ten years, or since the report of a similar committee made in 1922. The President, Mr. Harry E. Sawtell, has appointed the following members of that committee:

Arthur T. Safford, *Chairman*, Engineer, Proprietors of Locks and Canals, Lowell, Mass.
Arthur C. Eaton, Hydraulic Engineer, New England Power Engineering and Service Corporation, Boston, Mass.
X. Henry Goodnough, Consulting Engineer, Boston, Mass.
William D. Henderson, Civil Engineer, Jackson & Moreland, 31 St. James Avenue, Boston, Mass.
S. Stanley Kent, *Secretary*, Assistant Engineer, Proprietors of Locks and Canals, Lowell, Mass.
Harvey B. Kinnison, District Engineer, Water Resources Branch, United States Geological Survey, Boston, Mass.
William A. Liddell, Assistant Professor of Hydraulic Engineering, Massachusetts Institute of Technology, Cambridge, Mass.
R. R. Marsden, Dean, Thayer School, Dartmouth College, Hanover, N. H.
William Noyes, Operating Engineer, Public Service Company of New Hampshire, Manchester, N. H.
L. B. Puffer, Professor, University of Vermont, Burlington, Vt.
Caleb Mills Saville, Manager and Chief Engineer, Board of Water Commissioners, Hartford, Conn.
Howard M. Turner, Consulting Engineer, Boston, Mass.
William F. Uhl, Hydraulic Engineer, Charles T. Main, Inc., Boston, Mass.
Arthur D. Weston, Chief Engineer, Massachusetts Department of Public Health, Boston, Mass.
Frank E. Winsor, Chief Engineer, Metropolitan District Water Supply Commission, Boston, Mass.

The year 1931, while not one of extreme drought like 1930, has had enough low spots to warrant including it with 1930; and 1932 may continue the dry cycle.

The committee expect to bring up to date the records published in the report of the Society of 1922, and study and analyze them, stressing the year 1930 as one of extreme drought.

# PROCEEDINGS OF THE SOCIETY

## MINUTES OF MEETINGS

### Boston Society of Civil Engineers

October 21, 1931. — A regular meeting of the Boston Society of Civil Engineers was held this evening at Chipman Hall, Tremont Temple, and was called to order at 7 P.M. by the President, Harry E. Sawtell. There were about 100 members and guests present.

The Secretary, *pro tem*, announced that the following had been elected to membership by the Board of Government:

*Grade of Member:* Earle S. Cochrane, William Clark Custer, William John Downer, Peter Charles Malkowski, Frederick Mellor, Dexter S. Neil, Arthur Milliken Pillsbury, Albert Arthur Roberts, Earl Clay Robinson, George J. Rommer, Edwin W. Southworth, Jr., Charles H. Stimpson, Jr., Benjamin Eugene Sullivan, James Walter Urquhart, Roger G. Witherell.

The President announced the death of Charles S. Parsons who died on October 15, 1931, and who had been a member of the Society for over fifty years.

The President asked the members of the Society to stand for a moment with lights dimmed in memory of two eminent scientists and educators, Thomas A. Edison and Samuel W. Stratton.

The President read a letter from Mayor Curley urging organizations to improve their properties by making repairs, painting, etc., to aid unemployment. The President stated that the Society had appointed a committee which was making a study of the unemployment situation with regard to our membership, co-operating with a similar committee of the Boston Society of Architects.

Prof. Charles B. Breed, Chairman of the Joint Railroad Committee of the Boston Society of Civil Engineers and of the Engineering Societies of Boston, was then called upon to preside over the technical program for the evening the subject of which was "The New England Railroads — Consolidation and Ownership." Professor Breed discussed the conditions throughout the country leading up to the consolidation requirements of the Transportation Act of 1920.

Prof. J. B. Babcock gave a lantern slide talk, which included "A Brief Summary of the Location and Physical Characteristics of the New England Railroads, Interchange of Principal Connections, Character of Traffic and Operating Improvements."

Mr. John S. Lawrence, Treasurer and first President of the New England Council, who was a member of the New England Governors' Railroad Committee, discussed the report of that committee, describing the way the committee approached the problem and stating the reasons for their conclusions.

Professor Breed stated that the Joint Committee of the Societies had concurred with the majority report of the New England Railroad Committee.

Following this there was a question and discussion period in which a number of members took part.

The meeting adjourned at 9.50 P.M.

J. B. Babcock, *Secretary, Pro Tem.*

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November 18, 1931. — A regular meeting of the Boston Society of Civil Engineers was held today in Chipman Hall, Tremont Temple, and was called to order by the President, Harry E. Sawtell, at 7 P.M.

About 125 members and guests were present. Preceding the meeting the usual buffet supper was served.

The President announced the death of —

Howard A. Carson, on October 26, 1931; member since June 8, 1874, and Honorary Member since September 19, 1917.

Charles S. Parsons, on October 15, 1931, a member since April 21, 1880.

The President read a recommendation by the Board of Government regarding the use of income from the Permanent Fund, and it was

*Voted*, that the Board of Government be authorized to use the current income from the Permanent Fund in so far as necessary for current expenses of the Society.

The President then introduced Mr. H. Kenneth Fairbanks, engineer with the New England Public Service Company of Augusta, Maine, who gave a very interesting talk on the "Pneumatic Caissons for the Hydro-Electric Power Development at Bingham, Maine." This work necessitated the use of about 2,000 linear feet of pneumatic caissons to construct the concrete core wall for the earth-fill portion of the Wyman Dam. The total length of the dam is 2,800 feet and the operating head is 135 feet. The total capacity of the plant will be 100,000 horse power, two-thirds of the whole now being in operation. An artificial lake, twelve miles long, impounding two billion cubic feet of water in the top 15 feet, has been created by the Wyman Dam.

The talk was illustrated by lantern slides and by motion pictures.

Following the paper there was interested discussion and questions concerning this project.

Meeting adjourned at 10 P.M.

EVERETT N. HUTCHINS, *Secretary*.

## Designers Section

NOVEMBER 12, 1931.—The regular meeting of the Designers Section was called to order at 6.10 P.M. by the Chairman, Erwin Harsch, in the Affiliation Rooms.

Mr. Lawrence G. Ropes, acting as Clerk *pro tem*, read the minutes of the October meeting. They were approved by the section.

Mr. Herman G. Dresser was elected as Clerk to complete the unexpired term of Mr. Raymond A. Freeman, whose resignation had been read at the previous meeting.

"Moisture Penetration in Masonry Walls" was the subject of the speaker of the evening, Mr. Howard A. Gray, Engineer for Morton C. Tuttle Company. Mr. Gray discussed the general principals involved in the problem, among them being the need for walls to be able to breathe or eliminate moisture during dry periods. He then outlined in considerable detail the materials and methods of constructing brick building walls that would best resist the penetration of moisture.

Sixty-five members and guests were present.

The meeting adjourned at 7.50 P.M.

HERMAN G. DRESSER, *Clerk*.

## Northeastern University Section

OCTOBER 9, 1931. — The first meeting of the school year for the Northeastern University Section of the Boston Society of Civil Engineers was omitted this year. In place of this meeting, on October 9, 1931, the members went on an excursion to the new overpass at the junction of Massachusetts Avenue and Memorial Drive in Cambridge.

The group met with Professor Alvord at 2.30 at the site of the construction, and were escorted over the job by the engineer in charge, Mr. McSweeny, who explained the difficulties encountered in the construction.

The twelve members disbanded at 4.30.

RICHARD D. MURPHY, *Clerk*.

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NOVEMBER 10, 1931. — The Northeastern University Section of the Boston Society of Civil Engineers held a regular meeting on Tuesday evening, November 10, 1931, in Room 18–H. The meeting was called to order by Vice Chairman K. H. Gilson, and the report of the clerk was read and accepted. The election of a third member to the Executive Committee was then considered, but since this member should be from Division A, it was decided to hold the election at the next meeting, when Division A is at school.

Mr. Gilson then introduced the speaker of the evening, Col. F. M. Gunby, of the Charles T. Main Company. Colonel Gunby was an engineer in the Quartermaster Corps of the United States Army in addition to being employed by the Charles T. Main Company.

The subject chosen by Colonel Gunby was "What Comes Before Construction." During the course of his talk, he told of many of his experiences while in the army and while with Charles T. Main Company. The points which he brought out very forcibly were the use of tact and human relations in achieving success.

At the close of his address a question period was in order, after which refreshments were served to the thirty-two members and guests present.

RICHARD D. MURPHY, *Clerk.*

## APPLICATIONS FOR MEMBERSHIP

[December 20, 1929]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

### *For Admission.*

ALVES, FRANCIS JOSEPH, Boston, Mass. (Age 24, b. Provincetown, Mass.) Had two years at Rensselaer Polytechnic Institute and now a student at Northeastern University. Has had one year with New York State Division of Engineering as test man on Portland cement and one year with New England Power Company as carpenter's helper on dam construction. During the co-operative periods at the University has been employed by the city of Newton as rodman. Refers to *H. B. Alvord, C. O. Baird, J. W. Copithorne, J. B. Komich.*

DEMERS, ERNEST P., Holliston, Mass. (Age 21, b. Cochituate, Mass.) Graduate of Holliston high school and now a student at Northeastern University. During co-operative periods has worked for K. E. McIntyre of Franklin, Mass. Refers to *W. J. Alcott, C. O. Baird, C. S. Ell, G. H. Meserve.*

DI CARLO, FRANCIS W., South Boston, Mass. (Age 19, b. Beachmont, Mass.) Student at Northeastern University. Refers to *C. O. Baird, J. H. Lowe, J. B. Komich, G. H. Meserve.*

FELDMAN, LOUIS, Chelsea, Mass. (Age 22, b. Chelsea, Mass.) Is a student at Northeastern University. Refers to *W. J. Alcott, H. B. Alvord, C. S. Ell, W. E. Nightingale.*

GOLD, ISRAEL, Revere, Mass. (Age 22, b. Boston, Mass.) Student at Northeastern University. During co-operative periods has worked for Winebaum & Wexler as surveyor and draftsman. Refers to *W. J. Alcott, H. B. Alvord, C. S. Ell, W. E. Nightingale.*

HAMILTON, HARRY ROBERT, Brookline, Mass. (Age 24, b. Newport, R. I.) Student at Northeastern University, and during co-operative periods has worked in the engineering department of city of Newport; including layout of concrete roads, construction of storm sewers, sewerage pumping station, topographic and hydrographic surveys, also for C. R. Lynch on surveys, titles, etc. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, W. E. Nightingale.*

HINCKLEY, EVERETT, Brockton, Mass. (Age 21, b. Brockton, Mass.) Student at Northeastern University, and during co-operative periods has worked as transitman for Cobb, Beesby & Miles of Springfield, on high-power transmission lines. Refers to *W. J. Alcott, H. B. Alvord, C. O. Baird, C. S. Ell, W. E. Nightingale.*

PILLSBURY, GERALD T., Brookline, Mass. (Age 21, b. Scarboro, Maine.) Student at Northeastern University, and during co-operative periods has worked for Gleason Engineering Corporation. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, W. E. Nightingale.*

Pittendreigh, Lorrin Malcolm, Cambridge, Mass. (Age 20, b. Braintree, Mass.) Student at Northeastern University, and employed by Whitman & Howard during co-operative periods. Refers to *H. B. Alvord, C. O. Baird, J. H. Lowe, R. D. Murphy.*

Rapoport, Eugene J., Dorchester, Mass. (Age 22, b. Odessa, Russia.) Student at Northeastern University. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, W. E. Nightingale.*

Roche, Edward Charles, Boston, Mass. (Age 30, b. Boston, Mass.) Graduate of Massachusetts Institute of Technology in 1929, with degree of S.B. in sanitary and municipal engineering. October, 1929, to October, 1931, research assistant in sanitary engineering at Massachusetts Institute of Technology, and to date. Refers to *J. B. Babcock, T. R. Camp, Eugene Mirabelli, J. D. Mitsch, C. M. Spofford.*

### *Transfer from Grade of Junior.*

Brousseau, George Fred, Needham Heights, Mass. (Age 27, b. Putnam, Conn.) Graduate of Massachusetts Institute of Technology, 1926, with degree of S.B. in civil engineering. From September, 1926, to December, 1931, with Metcalf & Eddy, first as inspector of water pipe construction, then sewer design, hydraulic computation, cost estimates; from July, 1928, to July, 1929, inspector on 45 inches precast reinforced concrete sewer and 27 inches and 30 inches monolithic sewer construction at Bloomfield, N. J.; July, 1929, to October same year, resident engineer on 21 inches and 24 inches vitrified pipe and 27 inches and 30 inches monolithic concrete sewer construction at Bloomfield, N. J.; December, 1929, to July, 1930, resident engineer at Montclair, N. J.; July, 1930, to November same year, resident engineer at Torrington, Conn.; November, 1930, to June, 1931, resident engineer, concrete inspector, 69 inches, 78 inches, 90 inches semi-elliptical monolithic concrete sewer construction, Springfield, Mass.; June, 1931, to September same year, general office work and inspector on gravel-packed well construction at Woburn; September, 1931, to December, 1931, general office work, sewer design and cost estimates. Refers to *H. P. Eddy, Jr., A. L. Shaw, C. W. Sherman, J. P. Wentworth.*

Carlton, F. Tyler, Andover, Mass. (Age 27, b. Andover, Mass.) Graduate of Northeastern University in 1926. With Aspinwall & Lincoln during co-operative periods; one year in field office as computer for Southern California Edison Company; nine months with Boston City Planning Board as draftsman; one and one-half years as draftsman and detailer for New England Power Construction Company. Refers to *H. B. Alvord, A. B. Edwards, C. S. Ell, G. A. Haskins.*

Harding, John Henry, Newton, Mass. (Age 27, b. Allston, Mass.) Graduate of Massachusetts Institute of Technology 1927, with degree of B.S. in civil engineering; also studied advanced hydraulics at Lowell Institute in 1929. Experience: transitman, Lucerne-in-Maine Corporation, summer of 1926; October, 1926, to June, 1927, instrumentman, draftsman, city of Medford; October, 1927, to October, 1928, with International Paper Company as draftsman on Head Pond flowage survey, for Grand Falls, N. B., hydroelectric development, railroad reconnaissance, and loading tests for foundations; January, 1929, to August same year, concrete detailer with Stone & Webster Engineering Corporation; September, 1929, to February, 1931, in hydraulic division of Stone & Webster Engineering Corporation. At present unemployed. Refers to *D. V. C. Birrell, H. L. Bowman, J. J. Campobasso, T. B. Parker, G. R. Strandberg.*

## ADDITIONS

### *Member*

Max P. Standke, 67 Perthshire Road, Brighton, Mass.

## DEATHS

| | |
|---|---|
| Charles S. Parsons | Oct. 15, 1931 |
| Howard A. Carson | Oct. 26, 1931 |
| Ernest M. Young | Nov. 17, 1931 |

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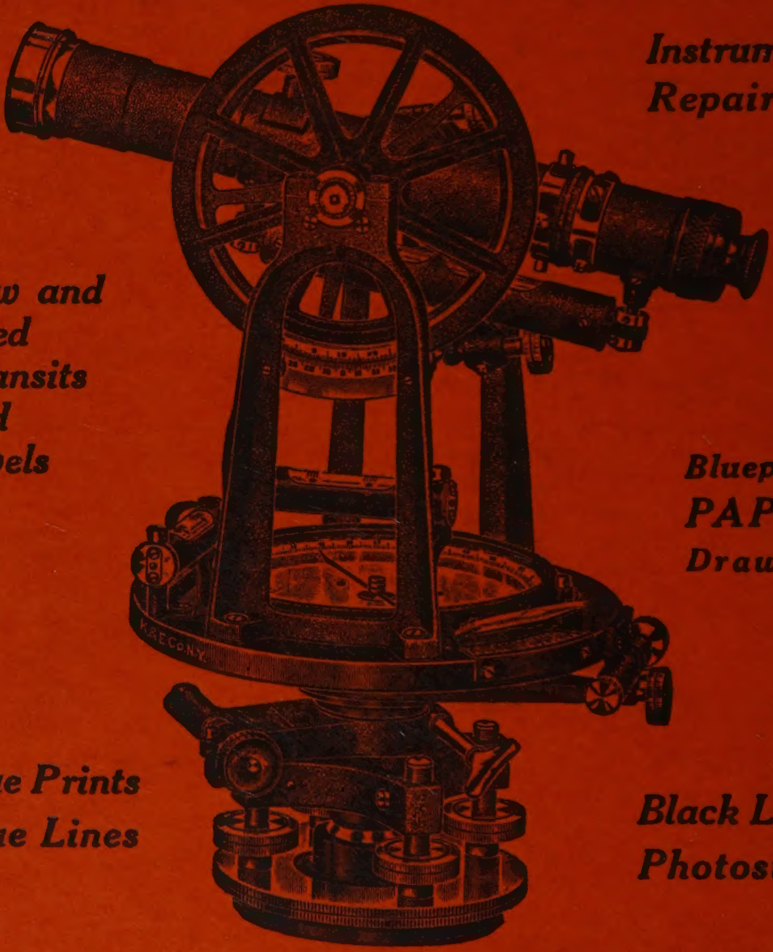

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